

# Hazardous Aquatic Animals



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# Hazardous Aquatic Animals



# 19

## 19.0 GENERAL

Many aquatic animals are potentially hazardous to divers. Although only a few present serious physical threats, several animals can inflict pain, precipitate an allergic reaction, or instantaneously create another disability that can seriously impair a diver's effectiveness. The ubiquity of hazardous creatures and their inclination to appear at inopportune times make it imperative to be aware of them, to respect their territorial rights, and to avoid needless unpleasant contact with them. This chapter discusses some of these animals and these unpleasant interactions. For convenience, hazardous aquatic life can be classified as those creatures that:

- Abrade, Lacerate, or Puncture (some of which may have an associated venom)
- Sting (envenomate)
- Bite
- Shock (electrical)
- Poison if eaten

## 19.1 GENERAL MEDICAL PROCEDURES

When rescuing a diver suffering from an injury due to an encounter with marine life and envenomation, the rescuer should anticipate near drowning, immersion hypothermia, decompression sickness, or arterial air embolism. The general principles of first aid (airway, breathing, circulation, and signs of shock) must be monitored. Appropriate treatment should be instituted immediately. Meticulous attention to basic wound management is necessary to minimize post-traumatic infection.

Seawater is not the most favorable irrigator as it carries a significant infection risk. Sterile water or saline are acceptable. Irrigation should be performed before and after debridement to maximize the benefits.

If a wound acquired in the natural aquatic environment (i.e., from an aquatic animal or contaminated with seawater or natural freshwater) becomes infected, seek immediate medical attention. The victim should be started

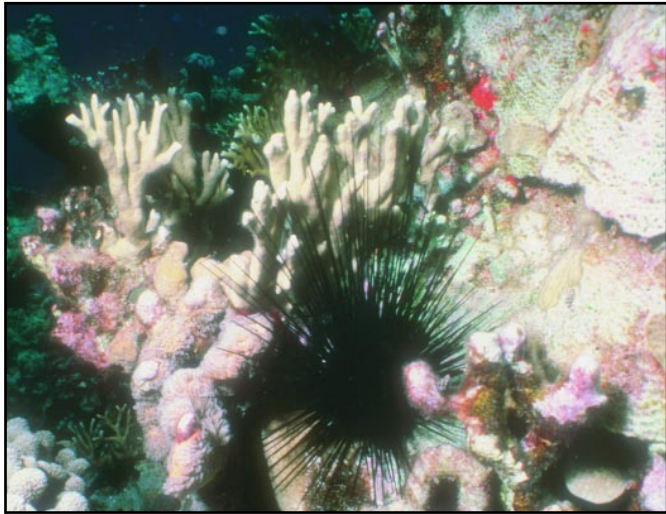
on an antibiotic to cover *Vibrio* species of micro-organisms (marine) or *Aeromonas* species of bacteria (freshwater). Use ciprofloxacin 500 mg, trimethoprim-sulfamethoxazole, one double strength tablet, or doxycycline 100 mg, giving any of these drugs in a dose, twice a day, orally.

Wounds should be thoroughly cleaned twice a day with soap and water or with a dilute antiseptic, such as povidone-iodine (10% maximum concentration), then rinsed with clean fresh (tap) water. Apply a thin coating of an antiseptic ointment, such as bacitracin or mupirocin, and cover with a non-adherent dressing, which should then be covered by an absorbent dressing. Any wound which disrupts the skin can become contaminated with *Clostridium tetani*. A proper anti-tetanus booster or immunization update should be administered. Tetanus has caused death following penetrating marine wounds.

Marine envenomations, such as those by the box-jellyfish, stonefish, and certain sea snakes may require the administration of specific antivenom. The rationale for administering antivenom is to provide early and adequate neutralization of the toxin at the tissue site before it gains systemic dominance.

## 19.2 ANIMALS THAT ABRADE, LACERATE, OR PUNCTURE

The bodies of many aquatic animals are enclosed in sharp, spiny or abrasive "armor" that can wound the exposed areas of a diver's body that may come into forceful contact with these creatures. Included in this group of animals are mussels, barnacles, sea urchins, and stony corals. The wounding effect caused by human contact with these animals is enhanced in aquatic habitats because human skin is softened by immersion. Wounds continuously exposed to water become macerated and resist healing. Wounds will be aggravated when exposed to tropical humidity or repetitive abrasion. Careless divers may, in time, become incapacitated by an accumulation of ulcerating sores. The chance of primary infections are due to unique bacteria which thrive in the salt-laden marine environment. Compounding the problem,



**FIGURE 19.1**  
**Sea Urchin**

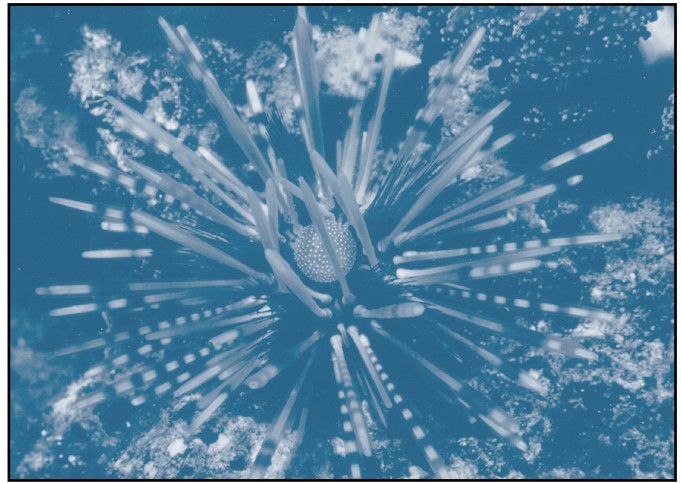
secondary infections in such wounds are not uncommon. Long-term diving projects may be jeopardized if participants fail to avoid and sufficiently care for these injuries, however minor they may initially seem. By wearing proper skin protection offered by immersion suits and diving gloves, divers will reduce their susceptibility to these injuries.

#### 19.2.1 Sea Urchins

Among the more troublesome animals for divers working near tropical reefs are venomous sea urchins. This concern applies especially after sunset when visibility is reduced and many of the noxious sea urchins migrate out of crevices and are more prevalent than during the day. Sea urchins (see Figures 19.1, 19.2) may also be a problem in temperate waters, but the species in these regions lack the potent venom found in the tropical species, and offer only a puncture rather than poisoning hazard.

Most difficulties with venomous sea urchins result from accidental contact with certain long-spined species (*Diadema*). With sufficient contact, the friable spines invariably break off in the wound and, being quite brittle, frequently cannot be completely removed. Gloves and protective clothing afford some protection against minor brushes with these animals, but may be limited when a diver strikes forcefully against them. In order to avoid painful injury, divers should avoid contact working close to venomous sea urchins. Divers should practice good buoyancy control, be observant, and avoid contact.

Some short-spined tropical urchin species called *pedicellariae*, are hazardous because of tiny pincer-like seizing organs, that are found among their spines. Although some *pedicellariae* hold receptacles for the urchin's potent venom, they are very small structures and usually do not pose a threat to divers who incidentally come into contact with them. It is prudent for a diver to be aware of the hazard found in *pedicellariae*, but when a diver is wearing gloves these urchins can be safely handled. The *Pacific Tripneustes* urchin carries a neurotoxin with a predilection for facial and cranial nerves.



**FIGURE 19.2**  
**Sea Urchin**

*lariae*, but when a diver is wearing gloves these urchins can be safely handled. The *Pacific Tripneustes* urchin carries a neurotoxin with a predilection for facial and cranial nerves.

#### Signs and Symptoms:

- Immediate sharp, burning pain
- Intense muscle aching and spasm
- Redness and swelling
- Spines sticking out of skin or black dots where they have broken off
- Purple discoloration of skin around the place spines entered (this is caused by retention of spine dye and does not necessarily indicate retention of a spine)
- Numbness
- Nausea and vomiting

#### Treatment:

Immerse the wound in non-scalding, hot water to tolerance 110–114°F (43.3–45°C). This frequently provides pain relief. Administer appropriate pain medicine. Spines that can be grasped, without crushing them, should be removed with tweezers. Spines that have been broken off flush with the skin are nearly impossible to remove; probing around with a needle will only break the spines into little pieces and further traumatize the area. Some spines will be dissolved by the body; others may fester and rise to the point where they can be removed with tweezers. Others will be surrounded by scar tissue and remain as minute nodules under the surface of the skin.

#### 19.2.2 Starfish

The Crown-of-Thorns starfish, (see Figure 19.3) *Acanthaster planci*, is a particularly venomous starfish found in tropical oceans worldwide. It carries sharp and



rigid ice-pick like spines which may grow to three inches in length. The cutting edges may easily penetrate most diving gloves and create a painful puncture wound with copious bleeding and slight swelling and numbness. Multiple puncture wounds may lead to vomiting, swollen lymph glands, and brief muscular paralysis.

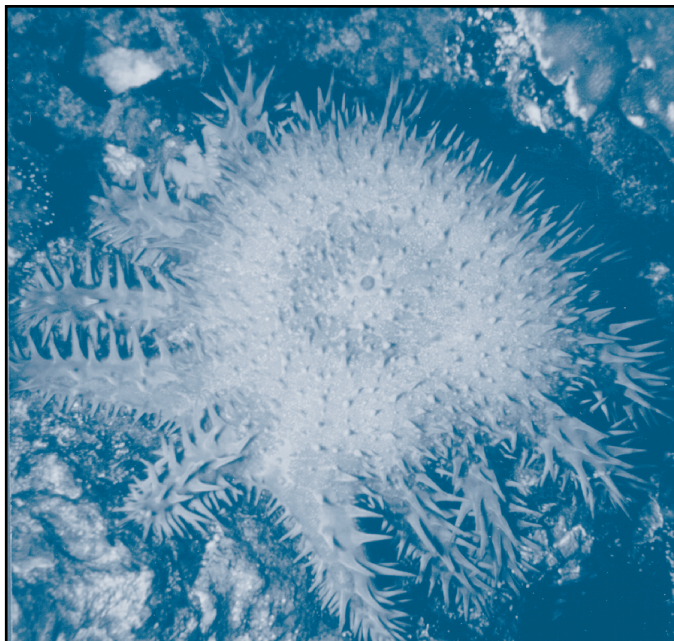
#### Signs and Symptoms:

- Pain is moderate with remission over one to three hours.
- Wound can become dusky or discolored.
- Multiple wounds may result in paraesthesia, nausea, and vomiting.

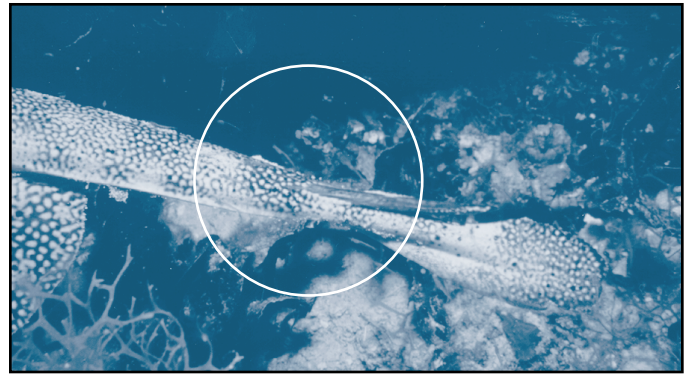
#### Treatment:

The treatment is similar to that for a sea urchin puncture. Immerse the wound in non-scalding, hot water to tolerance 110–114°F (43.3–45°C) for 30–90 minutes. This frequently provides pain relief. Unfortunately, with many of these wounds, the area is anaesthetized and the victim is able to tolerate quite high temperatures, well in excess of 114°F temperature. Therefore, always include an unaffected part of the body in the hot water to “sense” the temperature. This will avoid situations which can occur from hot water treatments causing further significant damage and necrosis in the wound area. Administer appropriate pain medicine. Carefully remove any readily visible spines. If there is a question of a retained spine or fragment, seek the assistance of a physician.

Handling other starfish, such as the sun or rose star, can cause a skin rash. This may be treated with topical calamine lotion with 1% menthol or 1% topical hydrocortisone lotion.



**FIGURE 19.3**  
**Crown-of-Thorns Starfish**



**FIGURE 19.4**  
**Stingray Tail with Spine**

#### 19.2.3 Rays and Fishes

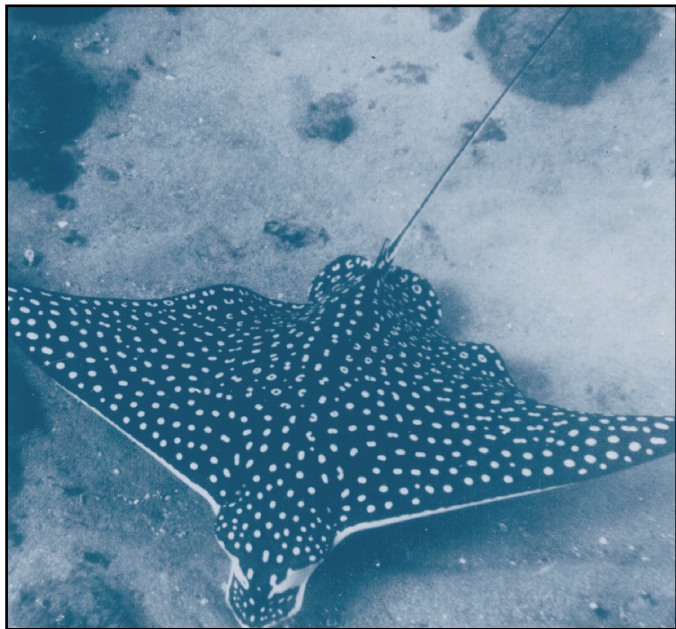
More than 1,000 species of fish are either poisonous to eat or venomous. The latter inflict these wounds more for protection than prey capture. Spines may be concealed in such locations as dorsal or tail spines, pectorally, on their heads, or elsewhere on their bodies. Generally, these fish injure only divers who deliberately handle or provoke them; however, some wound divers who have unintentionally touched them.

**Stingrays:** Stingrays are responsible for more human stings than any other group of fishes. The stingray is non-aggressive, but is capable of protecting itself against intruders. They have been recognized as venomous since ancient times, and were known as “demons of the deep” and “devil fishes.” Stingrays carry one or more spike-like spines near the base of their flexible tails which they can use effectively against persons who come in contact with them (see Figure 19.4). These spines can inflict venomous puncture wounds or a painful broad laceration. Humans are most vulnerable when wading along a sandy bottom in shallow water or swimming close to the ocean floor. Walking with a shuffling motion tends to frighten stingrays away. If the “wing” of a ray is significantly disturbed (i.e., stepped upon), the tail is whipped upwards as a reflex action. Compared to those of other stingrays, species of the family *Dasyatidae* (see Figure 19.5), present the greatest danger, as



**FIGURE 19.5**  
**Stingray (*Dasyatidae*)**





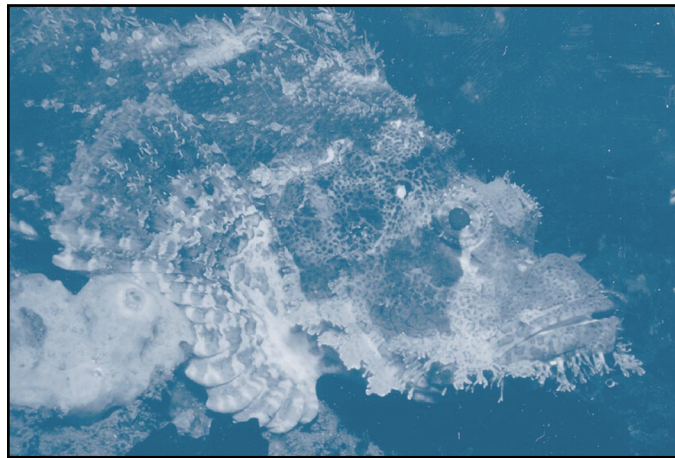
**FIGURE 19.6**  
**Stingray (*Myliobatidae*)**

they combine large size, the habit of lying immobile on the seafloor covered with sand, and a large spine that is carried relatively far back on a whip-like tail. Large rays of this type can drive their spines through the planks of a small boat or deeply into a human appendage. Swimmers coming into contact with the bottom and a stingray lying unseen in the sand have been mortally wounded when struck in the abdomen or chest, causing a pneumothorax. *Urolophid*, or round, stingrays have a short muscular caudal appendage with the spine attached and are able to deliver severe stings with a whip of their tail.

Less dangerous are stingrays of the family *Myliobatidae*, which includes the bat rays and eagle rays, even though these animals can be large and have long venomous spines on their tails (see Figure 19.6). The spine of this species is at the base of the tail rather than farther back and is a less effective weapon than the spine of the *Dasyatid* or *Urolophid* ray. Rather than lying immobile on the bottom most of the



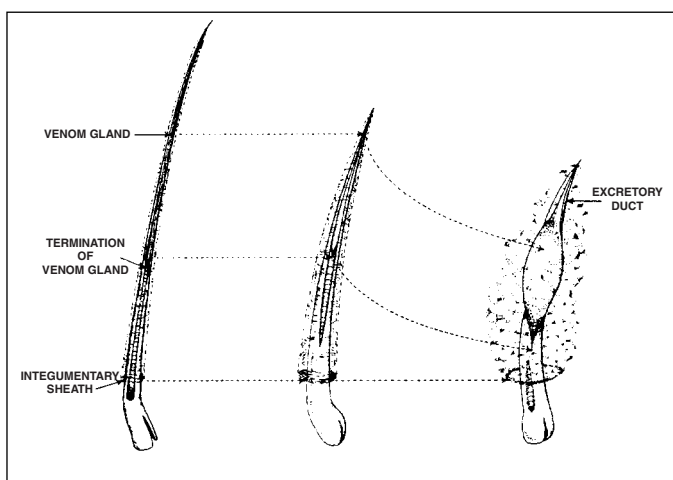
**FIGURE 19.7**  
**Manta Ray**



**FIGURE 19.8**  
**Scorpionfish**

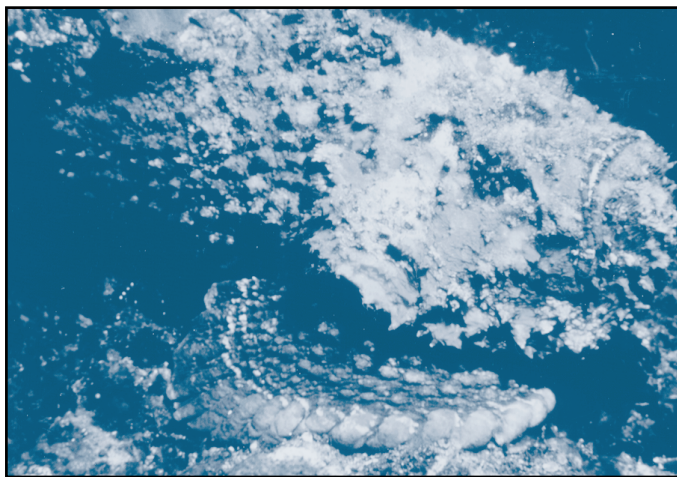
time, they more often swim through the midwaters, with their greatly expanded pectoral fins flapping gently like the wings of a large bird. When on the seafloor, *myliobatid* rays usually root actively in the sand for their shelled prey and are readily seen. Manta rays (see Figure 19.7) usually carry vestigial spines that pose little threat to the diver. Divers hitching a ride on this two-ton animal are more likely to be injured by falling off, or by ascending too rapidly.

**Scorpionfishes:** Scorpionfishes (see Figure 19.8) are among the most widespread family of venomous fishes and second to stingrays in envenomation incidents. The *Scorpaenidae* family, which numbers several hundred near-shore species, has representatives in all of the world's seas; the most dangerous forms are found in tropical areas. Many scorpionfishes are sedentary creatures that lie immobile and unseen on the seafloor. The family has three distinct groups, based upon their venom organ structure, and toxicity (see Figure 19.9). Lionfish, zebrafish, and butterfly cod of the *Pterois* type have long slender spines with



**FIGURE 19.9**  
**Three Types of Scorpionfish Dorsal Stings**

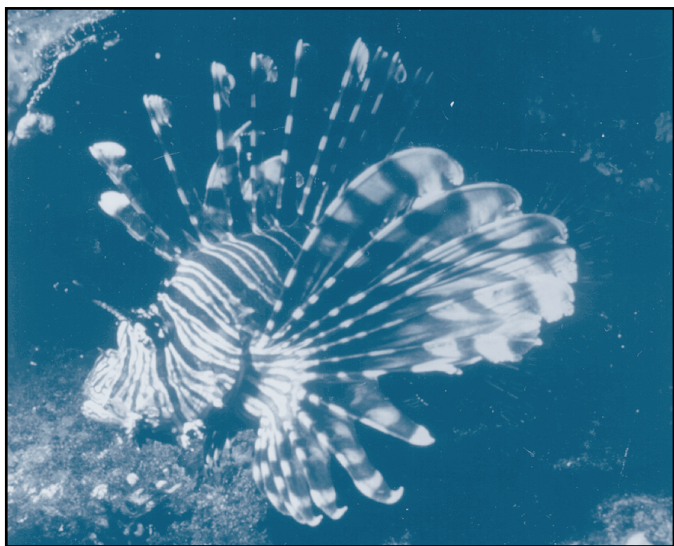




**FIGURE 19.10**  
**Stonefish**

small venom glands and a less potent sting. *Scorpaena* such as scorpionfish, bullrout, and sculpin (a common, near-shore scorpionfish species of Southern California), have shorter, thicker spines with large venom glands and more of a sting. Scorpionfish usually inject their venom with their dorsal fin spines and less often do so with the spines of their anal and pelvic fins. The *Synanceia* represented by the stonefish, (see Figure 19.10), common to the shallow, tropical waters of the western Pacific and Indian Oceans, have stout, powerful spines with highly developed venom glands and a potentially fatal sting which requires antivenom treatment. Although stonefish are not aggressive toward divers, their camouflage makes it easy to accidentally step on them unless special care is taken.

In contrast to the cryptic sculpin and stonefish, another group of scorpionfishes, the brilliantly hued lionfishes,



**FIGURE 19.11**  
**Lionfish**



**FIGURE 19.12**  
**Surgeonfish**

stand out strikingly against their surroundings (see Figure 19.11). Because lionfishes are beautiful animals that make little effort to avoid humans, an inexperienced diver or unwary marine aquarist may be tempted to grasp one. This will prove a painful mistake because lionfish venom is fairly potent.

**Surgeonfishes:** Some surgeonfishes, a member of the family *Scorpaenidae* (see Figure 19.12) can inflict venomous puncture wounds with their fin spines similar to those wounds produced by scorpionfishes and other similarly armed fishes. Many surgeonfishes can also inflict deep lacerations with knifelike spines (epidermal appendages) they carry on either side of their bodies, just forward of their tails. Some of the species have venomous spines. The more dangerous surgeonfishes, which belong to the genus *Acanthurus*, usually carry these spines flat against their bodies in integumentary sheaths. When threatened, the fish erect their spines at right angles to the bodies and attack adversaries with quick, lashing movements of their tails. Divers injured by surgeonfishes have usually been hurt while trying to spear or otherwise molest them.

Other fishes armed with venomous spines include the spiny dogfish, family *Squalidae*; weever fishes, family *Trachinidae*; toadfishes, family *Batrachoididae*; stargazers, family *Uranoscopidae*; freshwater and marine catfishes, family *Ariidae*; and rabbitfishes, family *Siganidae*. These fishes do not usually "attack" to drive their venom apparatus into their victims; instead, the force is supplied by the victims themselves who handle, step upon, or otherwise come into contact with these fishes.

Needlefish, slender, lightning-quick surface swimmers found in tropical seas, often leap out of the water in fear or when attracted to lights. On occasion, they have leaped and collided with people, spearing them in the chest, abdomen, extremities, head, and in one case causing a brain injury by penetrating the eye. Death may occur

from chest or abdominal penetration. “Flying” fishes pose less risk, as they have blunt heads.

### **Signs and Symptoms:**

- Severe, localized pain at the wound site, which may spread to involve the entire limb peaking around 60–90 minutes and lasting up to 12 hours if untreated.
- Wound will be discolored by a surrounding ring of cyanotic “bluish” tissue.
- Localized vasoconstriction, swelling, may be accompanied by an ashen appearance.
- Fainting, weakness, nausea, vomiting, headache, restlessness, limb paralysis.
- Respiratory distress, shock.
- Cardiac arrhythmias, cardiac arrest.

Recognize symptoms of diving-related disorder in the event of a fast ascent precipitated by painful envenomation at depth.

### **Treatment:**

Because fainting is common after a poisonous wound, particularly if there is severe pain, the victim should be removed from the water as soon as possible. The wound should be soaked in nonscalding, hot water to tolerance 110–114°F (43.3–50°C) for a period of at least 30 minutes. Remember to include an unaffected part of the body in the hot water to “sense” temperature. Administer appropriate pain medicine. In the treatment of fish and ray injuries, it should be noted that any puncture wound that involves body cavities (chest, abdomen) deserves immediate medical treatment, even if there is little clinical problem evident. Fatal complications can be either immediate or delayed; thus, investigation and hospitalization is required for these wounds.

The victim should be observed for any sign of difficulty breathing, profound weakness, or an abnormal pulse (heart) rate. The pain rarely lasts for more than 24 hours, unless there is a bit of fish spine retained in the wound, or if an infection has intervened. If the spine has penetrated to the bone then osteomyelitis may occur. Swelling may persist for up to a few weeks and may be associated with a clear watery discharge. Considerable local tissue necrosis, which may be best treated by excision, also may result. Medical assistance should be obtained as quickly as possible. An antivenom is available for administration in the event of a sting from the dreaded stonefish.

## **19.3 ANIMALS THAT STING**

A diverse array of otherwise unrelated primitive and extremely sophisticated animals is considered together in this section because their ability to inject venom into other organisms poses a threat to divers in the water. The instru-

ment of injection varies from the microscopic stinging cells of the coelenterates (hydroids, corals, anemones, and jellyfishes) to the rigid spines on the bodies of Crown-of-Thorns starfish, sea urchins, and fishes. There are also the harpoon-like radular teeth of cone shells, beaks of octopuses, bristles of annelid worms, and fangs of sea snakes. Mere contact with the surface of some sponges can produce severe dermatitis. The toxicity of the venom and the amount of venom introduced vary from species to species and sometimes among individuals of the same species. Furthermore, humans may differ in their sensitivity to a given venom. The reactions of humans to marine animal stings may range from no noticeable reaction to mild irritation to sudden death (usually from an allergic reaction, but occasionally due to a direct toxic effect). It is wise to be aware of and avoid injury by all marine organisms known to be venomous. Occasional contact may be inevitable, even among the most experienced divers.

### **19.3.1 Sponges**

Sponges handled directly from the ocean can cause two types of skin reaction. The first is an allergic type similar to that caused by poison oak, the difference being that the reaction generally occurs immediately after the sponge is handled. The skin becomes red, with burning, itching, and occasional blistering. A typical offender is the West Indian Fire Sponge found off the Hawaiian Islands and Florida Keys. The second type of reaction is caused by small spicules of silica from the sponges, which are broken off and embedded in the outermost layers of the skin. The red moss sponge (found in the northeastern U.S.) is a known culprit for this type of sting. All divers should wear proper gloves. To avoid unnecessary reactions, sponges should not be broken, crumbled or crushed with bare hands.

### **Signs and Symptoms:**

- Itching and burning skin a few hours after contact.
- Local joint swelling, stiffness.
- Redness, mottled skin.
- When large areas are involved, the victim may complain of fatigue, fever, chills, dizziness, and muscle cramps.
- Severe cases result in skin scaling off.

### **Treatment:**

Because it is difficult to tell which precise type of skin reaction has occurred, if a person develops a rash after handling a sponge, the following therapy should be undertaken: Soak the affected skin with white vinegar (5% acetic acid) for 15 minutes. This may be done by wetting a gauze pad or cloth with vinegar and laying it on the skin. Then dry the skin; apply the sticky side of adhesive tape to the skin and peel it off. This will remove most sponge fragments. An alternative is to apply a thin





**FIGURE 19.13**  
**Stinging Hydroid**

layer of rubber cement or a commercial facial peel; let it dry and adhere to the skin, then peel it off. Repeat the vinegar soak for 15 minutes or apply rubbing (40% isopropyl) alcohol for one minute. Once again, dry the skin, then apply hydrocortisone lotion (0.5 to 1%) thinly twice a day until the irritation is gone. If the rash worsens (blistering, increasing redness or pain, swollen lymph glands), this may indicate an infection. The victim should be started on an antibiotic to oppose *Vibrio* bacteria (ciprofloxacin, trimethoprim-sulfamethoxazole, or doxycycline). Proper tetanus immunization should be a part of sponge dermatitis therapy.

### 19.3.2 Hydroids, Jellyfishes, and Sea Anemones

Grouped here are a variety of organisms that drift or swim slowly at the water's surface or at mid-depths, as well as sessile bottom dwellers attached to rocks or coral outcroppings. Floating forms have gelatinous, semi-transparent, and often bell-shaped bodies with trailing tentacles armed with stinging cells, called nematocysts. In large specimens, these stinging tentacles may trail down as far as 100 ft. (30 m) into the water.

Nematocysts are characteristic of a large group of related, though superficially very diverse, marine animals known as coelenterates. In addition to the jellyfishes, the coelenterates also include the hydroids and stinging corals considered below. Different coelenterates have different types of nematocysts, but all function similarly. When the animal is disturbed, the nematocyst forcefully discharges a

venomous thread that, in some species, can penetrate human skin. The reactions of humans to the stings of hazardous coelenterates range from mild skin irritation to major organ failure and death.

Stinging hydroids (see Figure 19.13) occur on many reefs in tropical and temperate-zone seas. Typically, they are feather-like colonies of coelenterates armed, like jellyfish (see Figure 19.14), with nematocysts. Because colonies of these animals may be inconspicuous (they often extend only a few inches high), they may go unnoticed. Except to the occasional person who is hypersensitive to their stings, hydroids generally are more of a nuisance than a hazard. Divers are most likely to be affected on the more sensitive parts of their bodies, such as the inner surfaces of their wrists and arms. Although a diveskin or wet suit protects most of the body from the stings of hydroids, it will not protect against stings on the hands and face. Following a storm, the branches may be fragmented and disperse through the water, such that exposure will occur by just being in the vicinity.

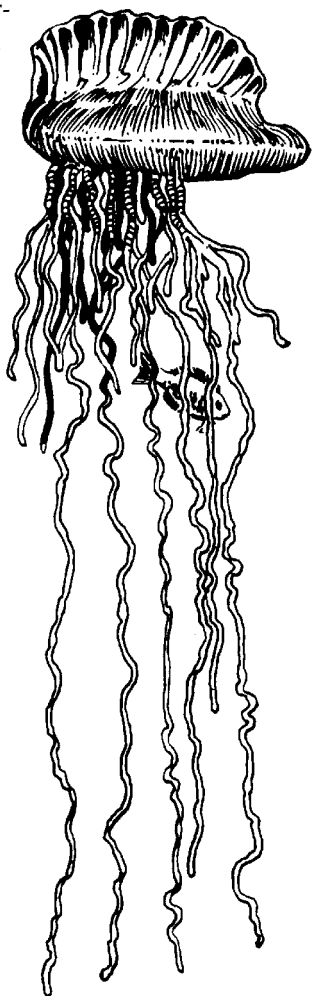
The Atlantic Portuguese Man-of-War, and the smaller Pacific Bluebottle, grouped together in the genus *Physalia*, are colonial hydroids known as polymorphic



**FIGURE 19.14**  
**Common Medusa Jellyfish**

colonial siphonophores. Siphonophores differ from the other forms, considered here as jellyfish, in that each organism is actually a colony of diverse individuals. These “individuals” each perform for the entire colony a specialized function, such as swimming or capturing prey. A gelatinous, gas-filled (carbon dioxide and nitrogen) float, which may be six inch or more in diameter, buoys the man-of-war at the surface; from this float trail tentacles as long as 45 ft. (15 m) laden with nematocysts. The *Physaliae* depend upon winds, currents, and tides for movement, travelling as individuals or in colonies resembling flotillas. Man-of-war stings can be dangerous to humans, so divers should stay well clear of these animals (see Figure 19.15). Unfortunately, even the most careful diver can become entangled in a man-of-war tentacle because these nearly transparent structures trail so far below the more visible float. It is especially difficult to detect fragments of tentacles that have been torn from the colony and are drifting free. The nematocysts on these nearly invisible fragments can be as potent as those on an intact organism. Dermatitis can result from contact with water containing venom that has already been released from nematocysts. In addition, a tentacle fragment washed up on the beach can retain its stinging potency for months, even in a semi-dried state. A Mediterranean octopus, *Tremoctopus*, stores intact segments in its suckers for later use.

More properly regarded as jellyfish are a group of carnivorous coelenterates known as scyphozoans; each individual is an independent, actively swimming animal adapted to deal rapidly with prey. These include the common jellyfishes encountered by divers in all oceans. Although many can sting, relatively few are lethal. The true giant jellyfish, typified by the genus *Cyanea* is often encountered by divers in temperate and arctic coastal waters of both the Atlantic and Pacific oceans. Tentacles of larger lion's mane or other specimens may exceed 100 ft. (30 m) in length. Divers should be aware that there is a chance of being stung even after they leave



**FIGURE 19.15**  
**Portuguese Man-of-War**

the water because segments of the tentacles of these animals may adhere to the diver's gloves. Touching the glove to bare skin, especially on the face, will produce a sting as painful as any received from the intact animal. Coelenterate dermatitis can develop under clothing as well where small pieces of tentacle are trapped and cause skin lesions. In Florida, thimble jellyfish larvae have caused extensive injuries when congregated in surface layers.

The most dangerous of the jellyfishes, *Chironex fleckeri*, belongs to a tropical subgroup of scyphozoans known as *cubomedusae*, often misnomered as “sea wasps.” The *Chironex* or box jellyfish of the Indo-Pacific possess an extremely virulent and potentially fatal sting that has caused deaths in humans (see Figure 19.16). Death within five minutes is possible, mostly from acute respiratory failure. An adult *Chironex* has enough venom (in excess of 10 ml) to kill three adults. These creatures prefer quiet, protected, and shallow areas off northern Queensland, Australia, but can be found in the open ocean. Fortunately for divers, the most dangerous species are usually encountered by unprotected ocean bathers.

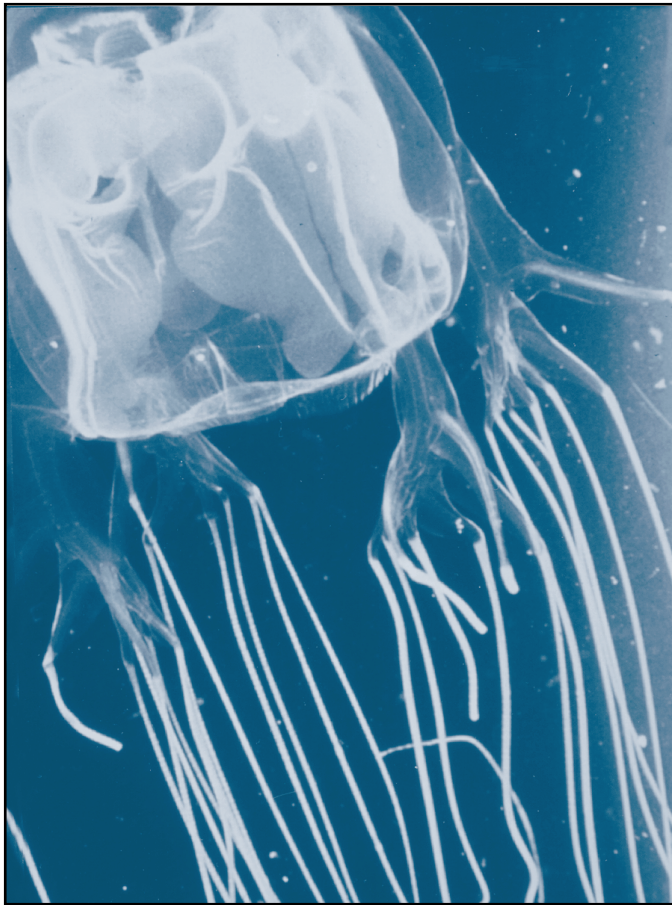
The class *Anthozoa* includes the sea anemones, stony corals and soft corals. They are treated here because they envenom. *Anthozoa* of various species are capable of inflicting painful wounds with their stinging cells. Anemones frequently look like beautiful flowers immersed in tidal pools, deceiving people into touching them. The reason for the name “Hell's Fire” sea anemone (*Actinodendron*) found in the Indo-Pacific region is apparent after contact. Sponge fisherman's (sponge diver's) disease is caused by contact with an anemone (*Sagartia* or *Actinia*) that attaches itself symbiotically to the base of a sponge. Exposure to the planktonic larvae of sea anemones has also caused outbreaks of coelenterate dermatitis.

#### Signs and Symptoms:

These vary depending on species, extent, and location of sting and a person's reaction:

- Pain ranging from a mild prickly sensation to an intense throbbing, shooting pain
- Reddening of the area (welts, blisters, swelling)
- “Frosted” (silvery) cross-hatched skin irritation, leading to necrosis (box jellyfish, see Figures 19.17, 19.18)
- Pieces of tentacle on affected area
- Cramps, nausea, vomiting
- Decreased touch and temperature sensation
- Severe backache
- Loss of speech
- Frothing at the mouth
- Constriction of the throat
- Respiratory difficulty
- Paralysis
- Delirium
- Convulsions
- Shock

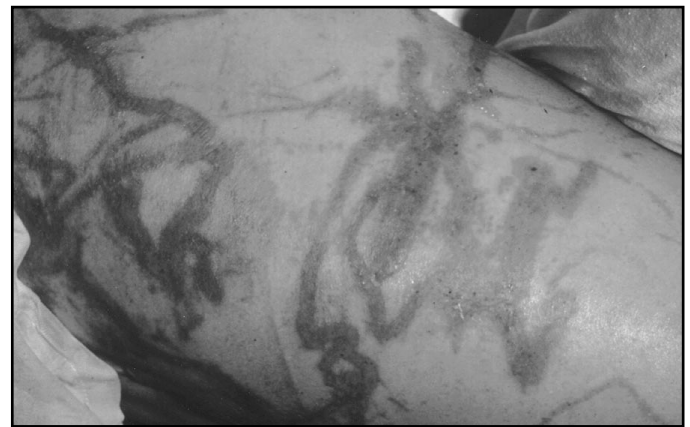
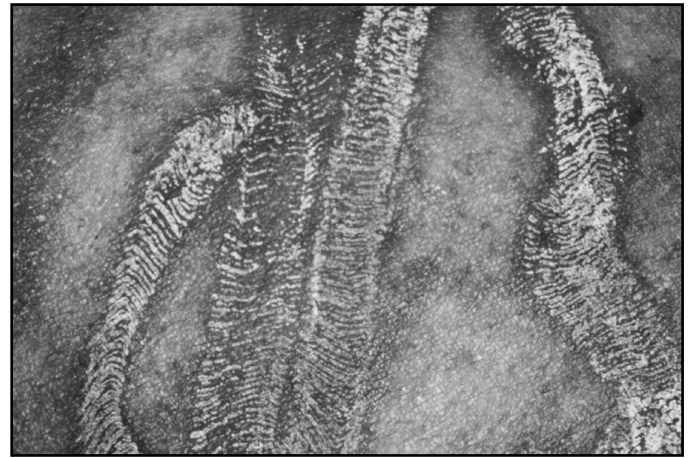




**FIGURE 19.16**  
**Box Jellyfish**

**Treatment:**

A diver who has been stung by a jellyfish should be removed from the water as quickly as possible. The rescuer should remove any tentacles, taking care not to come into contact with them. The wound area should be rinsed with 5% acetic acid or household vinegar (this is absolutely recommended for a box jellyfish sting prior to any attempt to remove tentacles adhering to the victim), sodium bicarbonate solution, or household ammonia solution to prevent untriggered nematocysts from discharging. Irrigating with vinegar is the most common recommended first-aid for most jellyfish stings, such as the *Cubomedusae* (*Cubozoan*) injuries. Alternative decontaminants include isopropyl (rubbing) alcohol or papain paste/powder (unseasoned meat tenderizer) or, for *Chrysaora* stings, administer a very strong mixture of baking soda in a slush. The area should **not** be rinsed with freshwater or rubbed with sand to remove any tentacles because this will cause increased stinging. A rinse under a freshwater shower of sufficient force to physically remove nematocysts, however, has been anecdotally reported to be helpful for east coast U.S. “jellyfish” stings. For treatment of jellyfish stings other than



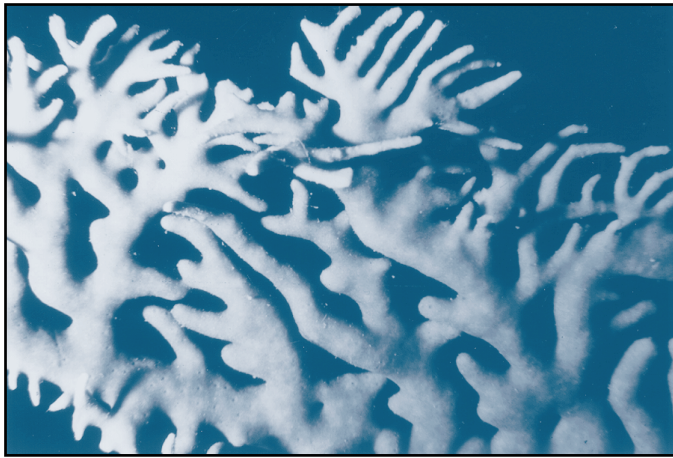
**FIGURES 19.17, 19.18**  
**Top Ñ Box Jellyfish Tentacles**  
**Bottom Ñ Sting/Skin Reaction**

*Cubozoan*, by far the most common treatments currently are ice or cold packs, anti-burn preparations, or anaesthetic preparations. The victim should be kept lying down with feet elevated, and monitored for signs of shock. CPR and oxygen should be administered if required. If signs of an allergic reaction are present, the victim should be injected with (subcutaneous) aqueous epinephrine 1:1000 (adult dose 0.3 to 0.5 ml) from an allergy kit (i.e., EpiPen®). If the allergic reaction is mild, an oral antihistamine (i.e., diphenhydramine 50 mg) can be administered.

Other treatments for a box jellyfish sting recommended by experts include application of a pressure-immobilization dressing and/or intramuscular injection of specific antivenom, which is available from Commonwealth Serum Laboratory of Melbourne, Australia. Early administration of box jellyfish antivenom is often associated with an immediate improvement in pain and other signs and symptoms.

After the skin surface is “decontaminated” and the nematocysts inactivated, the skin should be lightly shaved using a sharp-edged razor and shaving foam or a slimy paste of soap. Following this, the skin may be





**FIGURE 19.19**  
**Stinging or Fire Coral**

rinsed with freshwater. If the residual inflammation is significant, the victim may benefit from the administration of 1% topical hydrocortisone lotion.

### 19.3.3 Coral

Coral is common in most tropical waters. True corals are capable of inflicting serious wounds with their razor-sharp, calcareous outer skeletons. Because coral cuts are some of the most common injuries inflicted on divers in tropical waters, contact with corals should be carefully avoided. Divers should wear adequate hand, elbow and knee protection and insure their skin is completely protected when working among corals. Coral cuts tend to take a long time to heal; even if promptly and properly treated, they can lead to prolonged disability and skin infections. In extreme cases, the victim will develop cellulitis and wound necrosis. Some corals have stinging cells similar to those of jellyfish and produce a sting that rapidly disappears, but may leave red itchy welts.

Stinging corals, often called fire corals, belong to a group of colonial coelenterates known as millepores (see Figure 19.19). They are a widespread component in the development of tropical reefs among the more familiar stony corals, which they superficially resemble. Contact with the nematocysts of millepores affects humans in much the same way as contact with the nematocysts of stinging hydroids. Common Florida and Bahamas species have a characteristic tan-colored, blade-type growth, with lighter (almost white) upper portions. *Millepora* outcroppings assume upright, clavate, bladed, or branching calcareous encrustations over coral rock surfaces, or on the branches of soft corals such as alcyonarians. The *Millepora* zone of the outer Florida Keys ranges from 10–40 ft. deep (3–12 m). Unprotected and unwary divers handle, kneel, or lean upon this marine stinger regularly.

### NOTE

When a diver comes in contact with coral, in addition to the risk of personal injury, there is an environmental impact. Even an accidental brush against coral can wipe off the protective mucus coating of a reef-building coral, leaving it vulnerable to disease and infestation by marauding bacteria.

### Signs and Symptoms:

- Itchy, red, swollen area or wound
- Lingering, infected and oozing wound
- Lacerations or abrasions with bleeding

### Treatment:

The wound should be cleansed with soap and water to remove bacteria and foreign matter. An antiseptic ointment (i.e., mupirocin or bacitracin) should then be thinly applied and the wound covered with an absorbent sterile dressing which is changed daily. The victim should be started on an antibiotic to cover *Vibrio* species of micro-organisms (marine) or *Aeromonas* species of bacteria (freshwater). Use ciprofloxacin 500 mg, trimethoprim-sulfa-methoxazole, one double-strength tablet, or doxycycline 100 mg, giving any of these drugs in a dose, twice a day, orally. Aspirin or another mild analgesic may be used if the wound is painful; if severe, medical attention should be sought.

### 19.3.4 Marine Worms

Marine worms, which divers should avoid contact with, are classified in a class known as *polychaetes*. Two types that reportedly inflict stinging wounds are bristle worms and blood worms.

Bristleworms (see Figure 19.20), which divers often encounter when overturning rocks or amongst sponges, have tufts of sharp chitinous bristles along their segmented bodies that, in many species, can be erected when the animal is irritated. Easily detached, they penetrate the skin like cactus spines and are difficult to remove. Blood worms burrow in mud or sand. Their jaws contain venomous teeth and are able to inflict painful bites.

The bite or sting of a marine worm induces an immediate intense inflammation typified by a burning sensation with a raised, red, and itchy rash, most frequently on the hands and fingers. Untreated, the pain is generally self-limited over the course of a few hours, but the redness and itching may last for two to three days. With multiple punctures, there may be marked swelling.

### Signs and Symptoms:

- Intense burning inflammation with urticarial rash on hands and fingers
- Sensation of pricking and abrasion



**FIGURE 19.20**  
**Bristleworm**

#### **Treatment:**

Remove all large visible bristles with tweezers. Gently dry the skin, taking care to avoid breaking or embedding the spines further into the skin. Apply a layer of adhesive tape, non-caustic glue, or a facial peel to remove the residual smaller spines. Apply 5% acetic acid (vinegar), rubbing (40% isopropyl) alcohol, dilute ammonia, or a paste of unseasoned meat tenderizer (papain) for 10–15 minutes. If the residual inflammation is significant, the victim may benefit from the administration of topical 1% hydrocortisone lotion.

#### **19.3.5 Cone Snails (“Shells”)**

Certain tropical marine snails which inhabit cone-shaped shells are hazardous to divers. The shells are an especially attractive hazard because collectors are drawn to the colorful natural domicile of the most dangerous species (see Figure 19.21). There are more than 400 kinds of cone shells, each with a highly developed venom apparatus used to stun the small animals that are its prey. The weapon of cone shells is, thus, an offensive rather than defensive one. This fact helps to reduce the number of times people handling these shells are stung. Although only a relatively few of the cone shells are dangerous to divers, the stings of some can be deadly. Because cone shells inject their venom with a harpoon-like structure located at the narrow



**FIGURE 19.21**  
**Cone Snail Shells**

end of their shells, persons handling these animals should grasp them at the wide end. Nevertheless, extreme caution should be exercised as the proboscis can be extended to reach around to the opposite end of the animal.

#### **Signs and Symptoms:**

- Stinging or burning at wound site
- Numbness or tingling at wound site that spreads to the rest of the body
- Muscular paralysis
- Difficulty in swallowing and speaking
- Respiratory distress

#### **Treatment:**

A constricting band such as an elastic (Ace®) wrap or belt should be placed above the sting to prevent drainage from the wound but should not be tight enough to stop arterial flow. Loosen this constriction bandage for 90 seconds every ten minutes. An alternative is to apply the pressure-immobilization technique (see Figure 19.22). To do this, place a 2 x 4 inch cloth pad (1/4 inch thick) over the bite, and apply an elastic wrap firmly around the involved limb directly over the padded bite site. Allow a margin of at least four to six inches on either side of the wound, taking care to check for adequate circulation in the fingers and toes (normal feeling and color). Immediate medical attention should be sought. Careful observation is required in case of cardiac or respiratory failure. Be prepared to administer CPR.

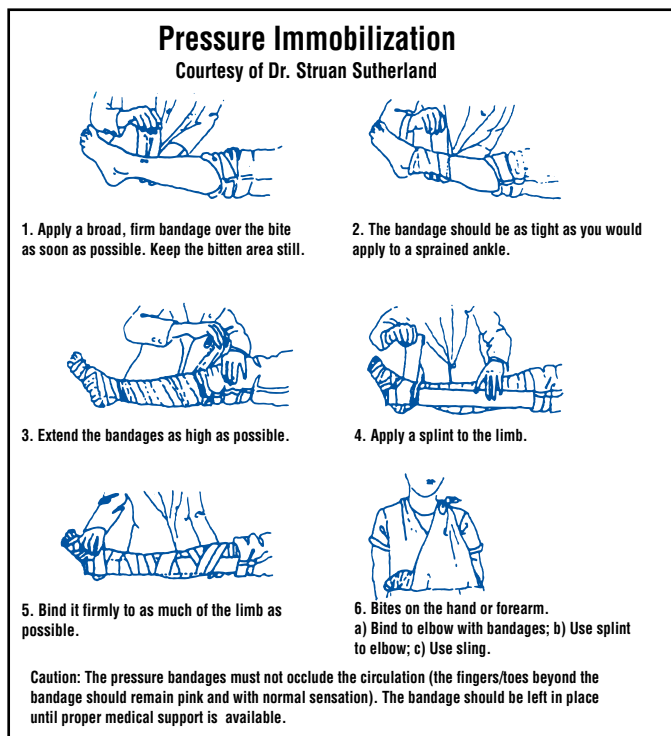
### **19.4 ANIMALS THAT BITE**

Serious injuries caused by the bites of non-venomous marine animals are rare. The possibility of such injury is psychologically threatening, however, because this hazard has been so widely publicized that many divers are distracted by it. It is important that working divers view this hazard realistically.

#### **19.4.1 Fishes**

**Moray Eels:** Moray eels, a member of the family *Muraenidae* (see Figure 19.23), are potential hazards of





**FIGURE 19.22**  
**Pressure Immobilization**

tropical reefs, and a few species live in the warmer temperate regions of California and Europe. Morays are bottom dwellers and can be found in and around crevices as well as in holes and under rocks or corals. They are rarely seen free swimming or on the reef top. Although relatively few eels grow large enough to threaten a diver seriously, some attain a size greater than 10 ft. (3 m). The tenacious moray with powerful jaws and long needlelike teeth, can seriously injure a human.

Divers injured by morays have usually been bitten when they are reaching into a reef crevice in order to grasp an object. An aggressive eel probably felt threatened or mistook the diver's hand for prey. Elderly, vision-impaired



**FIGURE 19.23**  
**Moray Eel**

eels may attack without provocation, particularly at night. The moray will usually release its grip when it recognizes that it has taken hold of something unfamiliar. If a diver can resist the impulse to pull free, he may escape with no more than a series of puncture wounds. But presence of mind is rare in such a situation, and a diver usually receives a severe laceration(s) when wrenching his hand from the backward-pointing teeth of the eel.

**Barracudas:** Barracudas, a member of the family *Sphyraenidae*, (see Figure 19.24) are potentially dangerous fishes that occur widely in the coastal waters of tropical and subtropical seas. A barracuda can reach 6–8 ft. (1.8–2.3 m) in length, and can weigh up to 110 pounds. With long, canine-like teeth in a large mouth, these fishes have the size and dentition to injure humans severely. The barracuda's teeth are adapted for seizing and holding prey.



**FIGURE 19.24**  
**Barracuda**





**FIGURE 19.25**  
**Great White Shark**

The teeth are particularly sharp on both edges, and produce a smooth cutting wound which may not cause much pain at the time, but bleeds copiously. Although barracudas seldom attack divers, they do so rapidly and fiercely, often out of confusion in murky waters. Where visibility is limited, for example, the barracuda may see only a moving hand or foot which may be mistaken for prey. Occasionally, a barracuda will be attracted to a diver (possibly out of curiosity), often at a distance of only a few meters, and sometimes into water no more than knee deep. An attack may also occur when a diver jumps into the water, as when entering the sea from a boat. To a nearby barracuda, the diver's splash may simulate the splash of an animal in difficulty—and hence vulnerable—and the barracuda may strike without realizing what made the splash. Thus, one should be especially alert in murky water to avoid unnecessary splashing when large barracudas may be present. The most common scenario leading to a barracuda bite involves attraction to the luring flash of metal, such as ankle jewelry on the dangling legs of a boater or the abnormal movements of speared fish.

**Sharks:** Sharks, more than any other animal, have generated sensational publicity as a threat to divers, even though shark bites are among the most infrequent injuries that divers sustain in the sea. Only a few of the many species of sharks threaten humans. Out of some 350 species of sharks known to ichthyologists, only 27 species have been incriminated in attacks on humans. The most frequent implicated offenders are the larger animals, such as the great white, blue, mako, bull, dusky, hammerhead, tiger, and grey reef sharks. Most sharks are non-offensive animals and do not threaten divers. Some generally docile

sharks, such as nurse and swell sharks, however, will bite divers who molest them. Although any large animal with sharp teeth should be left alone, the sharks discussed below may initiate unprovoked attacks on divers.

The great white shark (*Carcharodon carcharias*) shown in Figure 19.25 is responsible for more attacks on humans than any other species, particularly in the waters of southern Australia, the east coast of South Africa, the middle Atlantic coast of North America, and the coast north of Point Conception, California. The gray reef shark, numerous on tropical Pacific reefs, is a typical, potentially dangerous species (see Figure 19.26). This shark's unparalleled potential for destruction has repeatedly been incriminated in human attacks.

Sharks are carnivorous. The danger to humans is a combination of size, aggression, and dentition. Any creature over 3 ft. long that generally resembles this animal should be regarded cautiously, and if over 8 ft. long, should be avoided even if this requires that the diver leave the water. For example, grey reef sharks that range between 3 and 7 ft. (0.9-2.1 m) in length are numerous in shallow tropical waters, and diving operations often cannot be performed unless the presence of sharks in the area is tolerated. When such sharks are in the vicinity, divers should avoid making sudden or erratic movements. Common sense dictates that no injured or distressed animals should be in the water because these are known to precipitate shark attacks. When operations are conducted in the presence of sharks, each group of divers should include one diver who keeps the sharks in view and is alert for changes in their behavior. The chances of trouble are minimal as long as the sharks swim slowly and move naturally. The situation may become dangerous, however, if the sharks assume agitated postures, such as pointing their pectoral fins downward, arching their backs, or elevating their heads (snouts). In a mob frenzy, sharks become fearless and savagely snap at anything and everything, including each other. Most victims are attacked violently and without warning by single sharks. The first contact may be a "bumping" or an attempt by the shark to wound the victim prior to the definitive strike. Severe skin abrasions and lacerations from the shark skin (shagreen) denticles can be engendered in this manner.

The following are recommendations for avoiding and/or protecting one's self from potentially dangerous encounters with sharks:

- Avoid shark-infested waters, particularly at dusk and after dark. Do not dive in known shark feeding grounds.
- Swim in groups. Sharks tend to attack single swimmers.
- When diving, avoid deep drop-offs, murky, turbid water, or areas near sewage outlets.
- Maintain constant vigilance.
- Do not tether captured (i.e., speared) fish to your body.
- Do not corner or provoke sharks.



**FIGURE 19.26**  
**Gray Reef Shark**

- If a shark appears, leave the water with slow, purposeful movements. **DO NOT PANIC OR SPLASH.** If the shark approaches a diver in deep water, he should attempt to move to defensive terrain so that he is protected from the rear. If a shark moves in, attempt to strike a firm blow to the snout.
- If stranded at sea, and a rescue helicopter arrives, cautiously exit the water at the earliest opportunity. Surface chop and sounds created by rotor wash attract sharks.

#### **Treatment:**

The internationally agreed treatment for shark attack, once the diver has been rescued, is to:

1. Stop blood flow
2. Immobilize the wound
3. Ensure that no further hemorrhage is permitted, and that fluid replacement is adequate, prior to transportation to medical facilities

The jaws of a shark are crescent-shaped and contain a series of razor-sharp rip-saw teeth. The biting force of some sharks is estimated at 18 tons/square inch, and can inflict catastrophic wounds. Severe shark bites result acutely in massive tissue loss. In most cases, the immediate threat to life is hypovolemic shock. It may be necessary to compress the wounds or manually constrict arterial bleeding while the victim is in the water. As soon as the victim is out of the water, all means available

must be used to control bleeding. However, injudicious use of pressure points or tourniquets should be avoided. The patient will need intravascular volume replaced and should be kept well-oxygenated. Even if a shark bite appears minor, the wound should be washed out and bandaged and the victim taken to a doctor. Often the wound will contain pieces of shark teeth, seaweed, sand debris, and shark mouth flora which must be removed in order to avoid an infection. Like other animal bites, shark bites should not be sewn or taped tightly shut in order to allow drainage. This helps to prevent serious infection. The victim should be started on an antibiotic to oppose *Vibrio* bacteria (ciprofloxacin, trimethoprim-sulfamethoxazole, or doxycycline).

A bad scrape from the a shark's skin must be thoroughly cleaned and antiseptic ointment (i.e., mupirocin or bacitracin) with an absorbent dressing/bandage applied.

**Other fish that bite:** Any large fish with sharp teeth or powerful jaws can inflict a damaging bite. Generally, however, such fish are hazardous to divers only when they are handled. Pufferfish, wolffish, and triggerfish can be especially troublesome in this respect. These fishes have teeth and jaws adapted to feeding on heavily armored prey, and large specimens are quite capable of biting off a human finger. Triggerfishes (see Figure 19.27) are territorial and should be avoided if they seem aggressive.

In the tropics, some of the larger sea basses can grow to more than 10 ft. (3.0 m). These giant fish, including certain





**FIGURE 19.27**  
**Triggerfish**

groupers and jewfishes, are commonly seen by divers in tropical waters. Groupers are extremely curious, bold, voracious feeders which usually lurk around rocks, caves, caverns, and shipwrecks.

#### 19.4.2 Reptiles

Venomous snakes (see Figure 19.28) are a more widespread hazard in freshwater than in the sea. The cottonmouth (water moccasin) snake, which has a bite known to have been fatal to humans, may be the most dangerous animal hazard divers face in freshwater. This species, which is difficult to identify because of its highly variable coloration, does not show the fear of humans that is characteristic of most aquatic snakes. In regions inhabited by the cottonmouth, divers should avoid any snake that does not retreat. Wet suits afford reasonably good protection, but can be penetrated by the fangs of larger specimens. The diver should not attempt to strike back because this practice may result in multiple bites. Although the evidence is not conclusive, the cottonmouth is believed not to dive deeper than about 6 ft.. Another species to avoid is the timber rattlesnake, an excellent swimmer at the surface.

Venomous sea snakes of the genus *Astrotia fischer* occur only in tropical regions of the Pacific and Indian oceans. These reptiles have highly virulent venoms; fortunately, they generally do not bite humans unless handled. Sometimes a sea snake caught amid a netload of fishes will bite a fisherman. Generally, they are not aggressive toward divers who meet them under water except infrequently during mating season or if guarding an egg nest. Sea snakes are the most numerous of all reptiles and are sometimes seen in large numbers in the open ocean. Divers most often observe them amid rocks and coral where they prey on small fishes. They are agile underwater swimmers, and divers should not lose respect for their deadly bite simply because they are usually docile.



**FIGURE 19.28**  
**Sea Snake**

#### Signs and Symptoms:

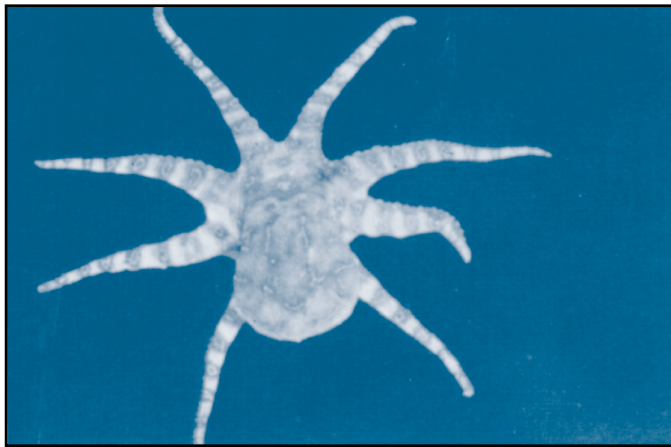
Signs and symptoms of sea snake envenomation, listed below, may be delayed for up to a few hours:

- Generalized malaise, anxiety, or, possibly, a feeling of well-being
- Difficulty with speech and swallowing
- Vomiting
- Aching or pain on movement
- Weakness, progressing within 1–2 hours to an inability to move, beginning in the legs
- Muscle spasm
- Droopy eyelids
- Thirst, burning dryness of throat
- Shock
- Respiratory distress
- Fang marks (two small punctures approximately one inch [1.3 centimeters] apart) and, possibly, a fang left in the wound

#### Treatment:

The victim must remain as calm and inactive as possible. The neurotoxic components of the venom are potent and act on neuromuscular transmission. If possible, apply the firm pressure-immobilization technique. Alternatively, a constricting bandage should be placed above the wound but should not be drawn so tightly as to interrupt arterial flow. The band should be periodically loosened, but not removed until the victim is in a suitable hospital. The victim should be transported immediately to the nearest medical facility for antivenom treatments. Serious envenomation occurs in approximately 25 percent of humans bitten by sea snakes. As the bite is a defensive act, the dose of venom injected is usually small. Therefore, sea snake antivenom is only indicated in those victims who show signs of serious envenomation. If one hour has elapsed since the bite and distinct muscle groups are not painful in passive movement, serious poisoning can be excluded. Antivenom has been proven effective even 7 or 8 hours after the bite, so it is desirable to wait until there is evidence of systemic poisoning before giving antivenom.





**FIGURE 19.29**  
**Blue-Ringed Octopus**

If possible, capture the snake for identification purposes, but take care not to become another victim.

#### 19.4.3 Octopi

Octopi are timid and highly intelligent creatures able to change color to match the slightest variation in the environment. The octopus has a beak capable of piercing shellfish, suction pads which are strong enough to pry open bi-valves and oysters, and defensive ink which can be used as a distracting escape decoy. There have been reported cases in which an octopus has actually attacked a diver when provoked or when retaliating against a spear or knife. Most species are harmless except for the blue-ringed octopus found in tidal rock pools around Australia (see Figure 19.29). The blue-ringed octopus bites prey with its parrot-like beak, secreting a salivary venom that enters the wound and subdues the prey. Most bites to humans are caused by people picking up or accidentally treading upon the octopus rather than it “attacking” humans. At least 14 cases of humans being bitten by octopus are recorded, one diver in Australia who allowed a blue-ringed octopus to crawl over his bare skin was bitten on the neck and died within two hours. The injected tetrodotoxin venom has a selective effect on nerve action potentials which induces paralysis and can be lethal. One average size octopus (weighing 26 grams) has enough venom to paralyze up to ten adult human beings.

#### Signs and Symptoms:

- Toxin has a short duration of action; complete onset of paralysis may be under ten minutes
- Difficulty in breathing, respiratory failure
- Fixed dilated pupils
- Weakness, paraesthesia, numbness, tightness in the chest

#### Treatment:

If the bite is from a blue-ringed or spotted octopus, apply the pressure-immobilization technique. An alternative

method is to simply wrap the entire limb at the described tightness with an elastic bandage. The wrap is meant to impede absorption of venom into the general circulation by containing it within the compressed tissue and microscopic blood and lymphatic vessels near the limb surface. The limb should be splinted to prevent motion. If the bite is on the hand or arm, also apply a sling. Be prepared to provide breathing assistance, if respiratory failure develops, until immediate medical attention is secured. For non-venomous bites, clean the wound with soap and water and apply antiseptic ointment and a bandage.

#### 19.4.4 Other Reptiles

Reptiles that bite, including turtles, alligators, and crocodiles are potential hazards to divers, both in freshwater and in the sea.

Turtles are frequently encountered by divers. Although the larger individuals of some species can injure divers with their bites, these animals are not generally threatening. The larger marine turtles have occasionally inflicted minor injuries, but several freshwater species are far more vicious and aggressive. These include the alligator snapping turtle and common snapping turtle of American freshwaters. The softshell turtle also may inflict a wound.

Alligators that have been encountered by divers, including the American alligator, have not proved threatening. Nevertheless, the potential for serious injury exists, and divers should be cautious. Any animal over 3 ft. (1 m) is likely to be dangerous.

Crocodiles are more dangerous than alligators. A species in the tropical western Pacific which enters coastal marine waters is feared far more than sharks by the natives. Crocodilians can move fast on land and in water, with recorded attacks including victims in boats, on dry land, and free swimming in deep water.

#### 19.4.5 Aquatic Mammals

Juvenile and female seals and sea lions frequently frolic in the water near divers. Underwater encounters with sea lions can be expected if the animals are nearby during a dive. Their activity can be distracting or even frightening, but it is rarely dangerous. Large bull seals and sea lions, although aggressive on the above-water rocks on their breeding rookery, apparently do not constitute a serious threat underwater. Divers have been seriously bitten and, therefore, should avoid ill-tempered and abnormally aggressive animals. A potentially greater danger when swimming with seals is being mistaken for a seal by a great white shark. Similarly, the infamous leopard seal of Antarctic waters is a threat that must be respected. If a leopard seal is sighted, diving should be suspended. If under water at the time, divers should not surface in open water, but follow the sea bed to the shore or to direct exit below the boat before ascending. If bitten

by a seal or sea lion, the diver should consult a physician because of the potential for unusual wound infections.

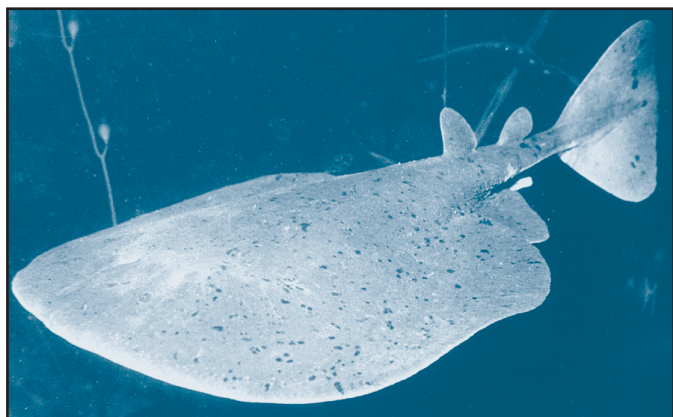
Common sense dictates that divers avoid large whales underwater. The killer whale can generate enough crushing power to bite a seal or porpoise in half with a single bite. Usually, whales stay clear of divers, so most incidents occur when divers put themselves in jeopardy by provoking the whales. A whale may be startled when a diver approaches too close and may strike a diver accidentally in a sudden surge of evasive action.

Muskrats are potential hazards in freshwater. Usually they attack only if they believe they are being threatened and their bites produce only minor wounds. There is a danger that rabies can be contracted from a muskrat bite, however, so in addition to seeking immediate medical advice, a diver who is bitten should make every effort to capture or kill the animal for examination.

The hippopotamus is a frequent killer in Africa. Unpredictable and bad-tempered, hippos have attacked boats and people in the water.

## 19.5 ANIMALS THAT SHOCK

The electric ray can be found in the temperate and tropical oceans of the world. The torpedo ray of California can grow to 6 ft. in length and weigh up to 200 pounds (see Figure 19.30). This ray is shaped somewhat like a stingray, except its “wings” are thick and heavy and the tail is flattened for swimming. Electric rays are slow-moving animals; alert divers should have little trouble avoiding them. As is true of so many undersea hazards, these animals threaten only those divers who molest them. The electric ray’s shock dose, which can be as high as 200 volts, is generated by modified muscles in the forward part of the animal’s disc-shaped body. Generally, the ventral side of the ray is negative and the dorsal side is positive. The shock, enough to electrocute a large fish, can stun a diver and induce drowning.



**FIGURE 19.30**  
Torpedo Ray

## 19.6 ANIMALS THAT ARE POISONOUS TO EAT

Most seafoods are edible and nourishing; however, several of the most toxic substances known are sometimes found in marine organisms. Mollusk shellfish, such as clams, mussels, and oysters are sometimes poisonous to eat when exposed to red tide blooms. These shellfish become poisonous because they feed on toxic dinoflagellates, which are microscopic plankton. Most of these episodes of poisoning have occurred along the Pacific coast from California to Alaska; the northeast coast from Massachusetts to Nova Scotia, New Brunswick and Quebec; and in the North Sea countries of Britain and West Germany. It is advisable to check with local authorities to determine what periods of the year are safe for eating mollusk shellfish. Violent intoxications and fatalities have also been reported from eating tropical reef crabs; these should not be eaten without first checking with the local inhabitants. Numerous species of tropical reef fishes are known to be poisonous to eat because they cause a disease known as ciguatera. An edible fish in one locality may be deadly in another. In addition, most pufferfish contain a deadly poison known as tetrodotoxin; puffers and related species should not be eaten. Improperly preserved fish, such as tuna, can generate toxins and become scombrototoxic, causing an allergic-type reaction in someone who ingests the toxic seafood.

### 19.6.1 Ciguatera

Ciguatera poisoning is caused by eating fish containing toxins (ciguatoxins), the products of certain species of algae eaten by the fish. Ciguatoxic fish are rarely identified out of the tropical reef zone identified by 35 north and south latitudes. About 800 species of fish have been known to carry ciguatera; the most common types being predaceous species; barracudas, groupers, snappers, jacks, wrasses, parrotfishes, and surgeonfishes. Currently it is impossible to distinguish toxic fish from harmless fish except by laboratory analysis or by feeding the suspected fish to animals and watching for a reaction. The occurrence of fish containing ciguatoxin is unpredictable and can occur in a fish species that was harmless the day before. The toxins are not destroyed by cooking. Because the concentration of toxins builds up over time, oversized fish of a given species are more likely to be toxic than smaller ones. The internal organs and roe of afflicted fish are particularly toxic. Severe ciguatera poisoning may cause severe disability or even death in humans.

**Signs and Symptoms:** (reported in over 150 cases) include:

- Numbness and tingling of the lips, tongue, and throat
- Abdominal cramps
- Nausea and vomiting



- Diarrhea
- Weakness, prostration
- Reversal of thermal sensitivity (hot feels cold and cold feels hot)
- Muscle and joint aching
- Nervousness
- Metallic taste in mouth
- Visual disturbances
- Extreme fatigue
- Muscle paralysis
- Convulsions
- Headache, dizziness and imbalance
- Heart failure

#### **Treatment:**

There is no definitive, first-aid field therapy available for ciguatera poisoning. If symptoms occur within four hours of eating fish, vomiting should be induced. Medical attention should be sought as soon as possible because the hospital treatment team may be able to administer mannitol through an intravenous route to treat severe neurological or cardiac symptoms. Other drugs may be helpful for certain severe symptoms, such as an antihistamine for itching or anti-nausea drug for nausea and vomiting. Rapid death is extremely rare. If paralysis of the respiratory system occurs, be prepared to assist respiration and if necessary administer CPR.

During recovery from ciguatera poisoning, the victim should exclude the following from their diet: fish, fish sauces, shellfish, shellfish sauces, alcoholic beverages, nuts, and nut oils. It should be noted that ciguatera poisoning has a 12 percent fatality rate, and that complete recovery may require many months, even years.

#### **19.6.2 Scombroid Poisoning**

Some scombroid (mostly dark-fleshed) fish (i.e., tuna, bonito, mackerel, bluefish) that have been exposed to sunlight or been left standing at room temperature for several hours may develop a toxin that is a type of histamine (the chemical perpetrator of allergic reactions). Such fish may have a peppery or sharp taste or may be completely normal in color, taste, or appearance. Within a few minutes of consumption, symptoms of this type of poisoning develop. The symptoms usually clear within 8–12 hours, although fatigue and headache may persist for a few days.

#### **Signs and Symptoms:**

- Nausea, vomiting, burning of throat
- Flushing of the face
- Diarrhea
- Abdominal pain
- Severe headache
- Dizziness
- Massive red welts
- Severe itching

- Severe dehydration (thirst)
- Shortness of breath and wheezing
- Bronchospasm, severe respiratory distress
- Cardiac palpitation
- Inability to swallow
- Shock

#### **Treatment:**

The victim should seek medical aid as soon as possible. Vomiting should be induced if it does not occur spontaneously. If the victim is short of breath or extremely weak, treat as if for an allergic reaction. Use epinephrine (adrenaline) (injected from an allergy kit, such as an EpiPen<sup>®</sup>, in an adult dose of 0.3 to 0.5 ml subcutaneously) and/or an oral antihistamine (i.e., diphenhydramine [Benadryl<sup>®</sup>] 50 mg or fexofenadine [Allegra<sup>®</sup>] 60 mg). The itching, rash, and headache usually respond to an oral antihistamine.

#### **19.6.3 Paralytic Shellfish Poisoning**

Paralytic shellfish poisoning can be linked to a dinoflagellate *Protogonyaulax* species. During the summer months, many shellfish which inhabit waters along the Pacific coast, Northeast Atlantic, or Gulf of Mexico may become poisonous. This lethal condition is caused by the ingestion of poisonous phytoplankton which contain different types of toxins that do not affect the shellfish but which can be poisonous to humans. Saxitoxin is the most frequently identified toxin. If a single dinoflagellate predominates, it can discolor the water creating a “colored” tide, of which red is commonly recognized. To the old axiom “don’t eat shellfish in the Northern hemisphere in months that do not contain the letter ‘r’” should be added “it doesn’t matter how you spell the month if the shellfish have been dining in *Gonyaulax*.” The poison works directly on the central nervous system so the usual symptoms of “food poisoning,” such as nausea and vomiting, are not generally present. The poison impairs breathing and may also affect the heart and circulation of the blood. Death, which occurs in severe cases, results from respiratory paralysis. Onset of symptoms is variable but may occur within 20 minutes of ingestion.

#### **Signs and Symptoms:**

- Tingling or burning sensation of the lips, mouth, tongue or face that spreads to other parts of the body
- Numbness
- Muscle weakness and paralysis
- Respiratory failure
- Infrequent nausea, vomiting, and other gastrointestinal ailments

#### **Treatment:**

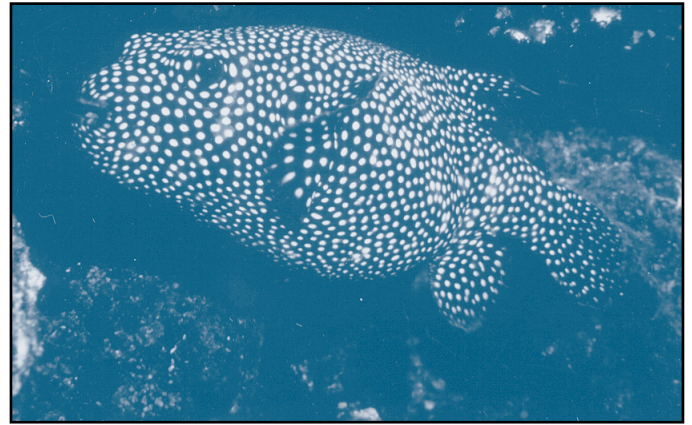
Vomiting should be induced as quickly as possible, and immediate medical attention should be sought. Rescuers should be prepared to provide mouth-to-mouth resuscitation or CPR.

#### 19.6.4 Tetrodotoxin “Puffer” Fish Poisoning

Certain puffers (blowfish, globefish, swellfish, porcupinefish) contain tetrodotoxin, one of the most potent poisons in nature (see Figure 19.31). These fish are prepared as a delicacy (“fugu”) in Japan by specially trained and licensed chefs. The toxin is found in the entire fish with greatest concentration in the liver, intestines, reproductive organs, and skin. After the victim has eaten the fish, symptoms can occur as quickly as ten minutes later or be delayed by a few hours. Because tetrodotoxin poisoning can be fatal to humans, it is wise to avoid eating puffers.

##### Signs and Symptoms:

- Numbness and tingling around the mouth
- Lightheadedness
- Drooling
- Sweating
- Vomiting
- Diarrhea, abdominal pain
- Weakness, difficulty walking
- Paralysis
- Difficulty breathing
- Collapse



**FIGURE 19.31**  
**Pufferfish**

##### Treatment:

If a person suffers from puffer poisoning, transport immediately to a hospital. Continually monitor the victims breathing, and assist if necessary. Unfortunately, there is no antidote; the victim will need sophisticated medical management until the toxin is metabolized.



## NOTES

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